

1993 Gordon Research Conference on Chronobiology

Final Report

National Aeronautics & Space Administration - NAGW-3645

William J. Schwartz, Chair

The Gordon Research Conference on Chronobiology was held from August 9 - 13, 1993 at Colby-Sawyer College, New London, New Hampshire. There were 169 applications to attend (to my knowledge, the largest number since the Chronobiology conference began in 1978). Of the 150 which could be accommodated and accepted, a total of 143 ultimately attended (Appendix A). Conferees came from 24 states; a little over 20% of the total represented 13 foreign countries, including two from former East Bloc nations; and nearly 30% of the participants were women. Graduate students, post-doctoral fellows, junior investigators, and senior scientists were all represented.

The study of biological timekeeping is now at a particularly fertile stage, encompassing multiple levels of biological organization, recruiting a wide array of disciplines and methodologies, and uniting a host of investigators, from plant geneticists to clinical psychiatrists. This vigor was reflected in the program (Appendix B), which consisted of 24 speakers, 9 discussion leaders, and 4 senior scientists as evening "commentators."

Two sessions on the first day focused on transcriptional and translational mechanisms of circadian rhythmicity, with discussions of putative "clock genes" in cyanobacteria, algae, fungi, fruitflies, and hamsters. The discoveries of prokaryotic circadian rhythmicity, time-dependent phosphorylation of the *per* protein, and rhythmic gene products in *per*⁰ flies - to name only a few examples - clearly pose new challenges to our understanding of circadian oscillators. Two sessions on the second day addressed cellular analyses, including work on photoreceptors in frogs, neurons in molluscs, testis in moths, and immortalized suprachiasmatic nucleus cells from rats. The characterization of a clock-like defecation rhythm in *Caenorhabditis elegans* was exciting, since this model organism, with its powerful genetics and cell biology, may now prove useful in studies of biological rhythmicity. Two sessions on the third day considered clocks as physiological systems, complete with inputs for entrainment and outputs for the overt manifestation of rhythmicity. Remarkable progress included the demonstration that multiple oscillators exist within individual unicells, the role of the intergeniculate leaflet in mediating non-photic entrainment in mammals, and the likelihood that the suprachiasmatic nucleus communicates its timing signal to the rest of the brain by multiple mechanisms. The final three sessions on the last two days were devoted to specific topics. First, new methods for investigating the circadian clock in the suprachiasmatic nucleus were introduced, including infusion of antisense nucleotides, studies of immediate early gene expression, and imaging of intracellular Ca²⁺ concentrations. A session on photoperiodism ranged from cellular studies in *Gonyaulax* to maternal-fetal communication in rodents. The final session on

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temperature and timekeeping included instructive presentations using chick pineal cells, social activity of voles, and hibernation in squirrels and bears. These examples demonstrated that the temperature compensation of the circadian pacemaker's free-running period need not imply a temperature insensitivity of the pacemaker's amplitude or of the entire circadian timekeeping system.

Poster sessions were also part of the formal activities of the conference. A total of 55 posters were organized by the Vice-Chair into two sessions (Appendix C), allowing participants a valuable overview as well as detailed information regarding many different research programs.

Throughout the conference, discussion was particularly animated, stimulating, and extensive. The atmosphere was conducive to the cross-fertilization and integration of disciplines, experimental approaches, and model organisms. These features contributed importantly to the success of the conference, as evaluated by the attendees (Appendix D). It is obvious from these comments that the Gordon Research Conference on Chronobiology continues to play a crucial role in the field, and the participants unanimously voted their desire to hold another conference in 1995.

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GORDON RESEARCH CONFERENCES

PAGE 16

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GORDON RESEARCH CONFERENCES

Gordon Research Conference on Chronobiology

August 9 - 13, 1993

Colby-Sawyer College (S), New London, N.H.

William J. Schwartz, Chair

Serge Daan, Vice-Chair

Monday Morning - 9:00 a.m. to 12:15 p.m.

Michael Rosbash (Brandeis Univ.), Discussion Leader
Transcriptional and Translational Mechanisms I

Takao Kondo (National Institute for Basic Biology, Myodaiji, Japan)
Prokaryotic circadian rhythms of gene expression reported by bacterial luciferase

Maria Mittag (Harvard Univ.)
Circadian control of gene expression in the bioluminescence system of the marine dinoflagellate *Gonyaulax polyedra*

Jon Kornhauser (Northwestern Univ.)
Light-activated signal transduction pathways in the suprachiasmatic nucleus

Monday Evening - 7:30 p.m. to 10:00 p.m.

Michael Young (Rockefeller Univ.), Discussion Leader
Transcriptional and Translational Mechanisms II

Jay Dunlap (Dartmouth Medical School)
Neurospora - the molecular identity of a clock gear and hand

Brigitte Frisch (Brandeis Univ.)
Elements of the *period* gene's cyclical expression in the *Drosophila* brain

Russell van Gelder (Stanford Univ.)
Circadian control of gene transcription in *Drosophila melanogaster*

Monday Commentary : Jerry Feldman (Univ. Calif., Santa Cruz)

Tuesday Morning - 9:00 a.m. to 12:15 p.m.

Arnold Eskin (Univ. Houston), Discussion Leader
Clocks in Culture

Gregory Cahill (Univ. Kansas Medical Center)
A circadian oscillator in vertebrate retinal photoreceptors

Gene Block (Univ. Virginia)
Cellular analysis of circadian rhythms in isolated neurons

David Earnest (Univ. Rochester Medical Center)
Establishment, characterization, and subcloning of immortalized cell lines derived from the rat suprachiasmatic nucleus

Tuesday Evening - 7:30 p.m. to 10:00 p.m.

J. Woodland Hastings (Harvard Univ.), Discussion Leader
Unfamiliar Clocks

Jaga Giebultowicz (U.S. Dept. Agriculture)
Circadian pacemaker in insect testis controls release and maturation of sperm

Dennis Liu (Univ. Washington)
Mutations affecting periodic behavior in *C. elegans*

Tuesday Commentary : Michael Menaker (Univ. Virginia)

Wednesday Morning - 9:00 a.m. to 12:15 p.m.

Serge Daan (Groningen Univ. Netherlands), Discussion Leader
Clocks *In Situ* - Input Mechanisms

Till Roenneberg (Univ. Munich)
Living with two clocks

Daniel Janik (Univ. Toronto)
Mechanisms of non-photoc phase shifting

Charles Czeisler (Brigham and Women's Hospital)
Mechanisms of entrainment of the human circadian pacemaker

Wednesday Evening - 7:30 p.m. to 10:00 p.m.

Fred Turek (Northwestern Univ.), Discussion Leader
Clocks *In Situ* - Output Mechanisms

Rae Silver (Barnard College)

What do suprachiasmatic nucleus grafts really do?

G. Robert Lynch (Univ. Colorado)

The suprachiasmatic nucleus *in vitro*, melatonin, and seasonal behavior
in the Djungarian hamster

Wednesday Commentary : Colin S. Pittendrigh (Stanford Univ.)

Thursday Morning - 9:00 a.m. to 12:15 p.m.

Martha Gillette (Univ. Illinois), Discussion Leader
Suprachiasmatic Nucleus - New Tools

Phyllis Wise (Univ. Kentucky College of Medicine)

Use of antisense nucleotides to study the circadian clock

Michael Hastings (Univ. Cambridge, U.K.)

Functional domains of the suprachiasmatic nucleus

Anthony van den Pol (Yale Univ. School of Medicine)

Digital imaging of cellular behavior in the suprachiasmatic nucleus

Thursday Evening - 7:30 p.m. to 10:00 p.m.

Steven Reppert (Massachusetts Gen. Hosp.), Discussion Leader
Photoperiodic Mechanisms

Rüdiger Hardeland (Univ. Göttingen, Germany)

Photoperiodism at the cellular level: rhythms and effects of
indoleamines in *Gonyaulax polyedra*

Theresa Lee (Univ. Michigan)

Communication of photorefractoriness from mother to pups

Thursday Commentary : Robert Y. Moore (Univ. Pittsburgh)

Friday Morning - 9:00 a.m. to 12:00 p.m.

Irving Zucker (Univ. Calif., Berkeley), Discussion Leader
Temperature and Timekeeping

H. Craig Heller (Stanford Univ.)
Circadian rhythmicity in hibernating ground squirrels

Menno Gerkema (Univ. Groningen, Netherlands)
Synchronization of ultradian activity rhythms in common voles: the role
of environmental temperature

Martin Zatz (Natl. Inst. Mental Health)
Thermal effects on melatonin rhythms in chick pineal cells

GORDON CONFERENCE CHRONOBIOLOGY 1993

POSTER EXHIBITS

EXHIBIT A:

Posters up: Monday morning

Posters down: Wednesday morning

Monday 16:30-18:00:

Poster session A1, authors of posters A1-A13 present at their posters.

Tuesday 16:30-18:00:

Poster session A2, authors of posters A14-A26 present at their posters.

EXHIBIT B:

Posters up: Wednesday morning

Posters down: Friday morning

Wednesday 16:30-18:00:

Poster session B1, authors of posters B1-B13 present at their posters.

Thursday 16:30-18:00:

Poster session B2, authors of posters B14-B26 present at their posters.

GORDON CONFERENCE CHRONOBIOLOGY 1993

POSTERS

EXHIBIT A. (August 9-10)

- A-1 Michael T. Lewis, Jerry F. Feldman (University of California, Santa Cruz):
Comparative phylogenetic analysis of the *frq* (frequency) clock locus from several fungi reveals conserved and non-conserved regions.
- A-2 David K. Welsh, Diomedes E. Logothetis, Steven M. Reppert (Laboratory of Developmental Chronobiology, Massachusetts General Hospital; Dept. of Cardiology, Children's Hospital, Program in Neuroscience, Harvard Medical School, Boston):
Synaptic and nonsynaptic communication among cells cultured from rat suprachiasmatic nucleus.
- A-3 James Comolli, Walter Taylor, J.W. Hastings (Biological Laboratories, Harvard University, Cambridge, MA):
Inhibitor of protein phosphorylation lengthens *tau* and blocks light phase shifts in *Gonyaulax polyedra*.
- A-4 Marija Medanic, Martha U. Gillette (Department of Cell and Structural Biology, University of Illinois, Urbana, IL):
The mammalian circadian pacemaker shows bimodal sensitivity to regulation by neuropeptide-Y.
- A-5 S. Michel, K. Manivannan, J.J. Zaritzky, G.D. Block (Department of Biology, University of Virginia, Charlottesville, VA):
Whole cell currents in cultured circadian pacemaker neurons of *Bulla*.
- A-6 M. M. Moga, R. Y. Moore (Depts. of Psychiatry, Neurology, Behavioral Science and the Center for Neuroscience, University of Pittsburgh):
The paraventricular thalamic nucleus as a component of the circadian timing system in the rat.
- A-7 Bernard Possidente (Skidmore College, Saratoga Springs, NY):
Olfactory bulb role in a mouse circadian system.
- A-8 Wolfgang Puchalski, G. Robert Lynch (Dept. Biology, Wesleyan University, Middletown, Ct.):
Photoperiodic time measurement in Djungarian hamsters evaluated from T-cycle studies.
- A-9 Arcady A. Putilov (Biological Rhythms Research Lab. Institute of Physiology, Siberian Branch, Russ. Acad. of Med. Sciences, Novosibirsk, Russia):
A somnostat model can predict time course of slow wave activity during multiple sleep latency test.
- A-10 Martin Ralph, Diego Golombek, Gerry Honrado, Mark W. Hurd (Department of Psychology, University of Toronto):
Transgenic mice and circadian clocks: Fos-less and NGF Receptor-less, but not Timeless.

- A-11 O. van Reeth, Y. Zhang, M. Lesourd, F. W. Turek (Dept. Neurobiology & Physiology, Northwestern University, Evanston; Centre des Rythmes Biologiques, University of Brussels; Servier Company, Paris):
Chronic treatment with sulbutiamine can reverse some age-related changes in hamster's circadian rhythms.
- A-12 Alan Rosenwasser (Department of Psychology, University of Maine): Do presynaptic alpha-2 noradrenergic autoreceptors mediate circadian phase-shifting by clonidine ?
- A-13 Alan Rosenwasser (Department of Psychology, University of Maine):
Photic and non-photic phase-shifting associated with routine cage-maintenance.
- A-14 Martha W. Merrow, Jay C. Dunlap (Department of Biochemistry, Dartmouth Medical School, Hanover, NH):
Functional and molecular characterization of a homolog of *N. crassa* *frq*.
- A-15 François Rouyer (Dept. of Biology, Brandeis University, Waltham, MA)
Cloning of a circadianly regulated gene expressed in the head of *Drosophila melanogaster*.
- A-16 Norman F. Ruby, H.C. Heller (Dept. of Biological Sciences, Stanford University, Stanford, CA):
Low temperature shortens the period of circadian neuronal rhythms in the suprachiasmatic nucleus (SCN) of golden-mantled ground squirrels *in vitro*.
- A-17 Peter Ruoff (Rogaland University Center, Stavanger, Norway):
Temperature compensation in any reaction kinetic model of circadian oscillations.
- A-18 Kazuhiro Shimomura, Michael Menaker (Dept. of Biology, University of Virginia, Charlottesville VA 22901)
Effects of the *tau* Mutation on Circadian Phase Shifting by Light.
- A-19 Kathleen K. Siwicki, M.G. Folwell, W. Bug, P. Jacobs, K. Shinkai, Z. Verney, M. Bucan (Biology Department, Swarthmore College, Swarthmore, PA 19091)
Cellular rhythms in the PER antigen in *Drosophila* and *Manduca*.
- A-20 Junichi Takeuchi, William Shannon, Neil Anonin, William J. Schwartz (Department of Neurology, University of Massachusetts):
Compositional changes of AP-1 DNA-binding proteins are regulated by light in a mammalian circadian clock.
- A-21 Barbara Tate (Dept. of Psychiatry, Miriam Hospital, Providence, RI):
Circadian abnormalities induced by the Alzheimer beta-amyloid protein.
- A-22 N. Viswanathan, Fred C. Davis (Dept. of Biology, Northeastern University, Boston, Ma.):
Activation of dopaminergic system mediates maternal entrainment in hamsters.

- A-23 G. T. Wassmer, T. L. Page (Dept. of Biology, Vanderbilt University, Nashville, Tn.):
Photoperiodic regulation of a putative storage protein in the cockroach *Parcoblatta pennsylvanica*.
- A-24 E.T.Weber, M.U.Gillette (Department of Physiology, University of Illinois, Urbana, Ill.):
Identification of protein kinase G as an SCN substrate for phosphorylation during the circadian cycle.
- A-25 C. R. McClung, Z. R. Liu, E. A. Pease, M. L. Pilgrim, H. H. Zhong ():
Circadian and light regulated gene expression in *Arabidopsis*.
- A-26 Daniel F. Kripke (University of California, San Diego, La Jolla):
Human light exposure and its correlates.

EXHIBIT B (August 11-12)

- B-1 P. Badhakchani, N. W. S. Chong, C. Coen, K. Marsden, J. F. Powell, I. C. Campbell (Institute of Psychiatry and King's College, London, U.K.):
Circadian studies of rat SCN: temporal differences in mRNA expression.
- B-2 N. W. S. Chong, P. Badhakchani, C. Coen, K. Marsden, J. F. Powell, D. Sugden, I. C. Campbell (Institute of Psychiatry and King's College, London, U.K.):
Differential expression of an mRNA in chick pineal over 24 hours.
- B-3 Ivonne Balzer (Zoological Institute, University of Göttingen, Germany):
Circadian rhythmicity of encystment and excystment in *Gonyaulax polyedra*.
- B-4 Stephany M. Biello, N. Mrosovsky (Depts. of Zoology and Physiology, Univ. of Toronto, Ont. Canada M5S 1A1)
Antiserum to neuropeptide-Y attenuates phase shifts in response to induced wheel running.
- B-5 Pamela J. Carter, Malcolm B. Wilkins, Hugh G. Nimmo, Charles A. Fewson (Dept. of Botany and Biochemistry, Glasgow University, Glasgow G12 8QQ, U.K.):
Temperature regulation of phospho-enol-pyruvate carboxylase activity in relation to the circadian rhythm of CO₂ exchange in *Bryophyllum* leaves and the temperature compensation of the period.
- B-6 Patricia J. DeCoursey, C. Sandlin, S. Pius, C. Herrin (University of South Carolina, Dept. of Biological Sciences, Columbia SC):
Relationship of Circadian Temperature Cycles and Activity Rhythms in Rodents.
- B-7 A. Diez-Noguera, A. Campuzano, J. Vilaplana, T. Cambras (Laboratori de Fisiologia, Facultat de Farmacia, Universitat de Barcelona):
Effects of period length of light/dark cycles in the circadian rhythms of motor activity and in the growth rate of young Wistar rats.

- B-8 Takashi Ebisawa, Yukiko Sasaki, Takeo Deguchi (Lab. of Developmental Chronobiology, Massachusetts Gen Hospital, Boston, USA):
Complementary DNA's for Two Arylamine N-Acetyltransferases with Identical 5'-Noncoding Region from Rat Pineal Gland.
- B-9 Isaac Edery (Dept. of Biology, Brandeis University, Waltham, MA)
Temporal Phosphorylation of the Drosophila Period Protein.
- B-10 Jeffrey A. Elliott, Colin S. Pittendrigh (Dept. Psychiatry, U.C. San Diego):
Phase relationship of evening and morning oscillators regulates amplitude of hamster PRC to light.
- B-11 Beatrix Fuentes-Pardo, M. Lara-Aparicio, S. López de Medrano (Departamento de Fisiología, Facultad de Medicina, Instituto de Matemáticas Universidad nacional Autónoma de México, México 04510, MÉXICO)
Mathematical simulation of the action of external stimuli on the circadian rhythm of electroretinogram of crayfish.
- B-12 Menno P. Gerkema, Eddy A. van der Zee, Louis E. Feitsma (Zoology Laboratory and Department of Animal Physiology, Groningen University):
The number of arginine-vasopressin immunoreactive cells in the SCN correlates with the degree of expression of circadian rhythmicity in common voles, *Microtus arvalis*.
- B-13 M.E.Geusz, S.Michel, G.D.Block (Department of Biology, University of Virginia, Charlottesville, VA):
Intracellular calcium responses of circadian pacemaker neurons measured with fura-2.
- B-14 R. Keith Barrett, Joseph S. Jakahashi ((NSF Center for Biological Timing, Dept. of Neurobiology and Physiology, Northwestern University, Evanston IL 60208)
Temperature compensation of the chick pineal circadian clock.
- B-15 Mona Castel (Department of Cell and Animal Biology, Hebrew University of Jerusalem):
Organotypic culture of the suprachiasmatic nucleus, particularly the GABA-ergic innervation.
- B-16 Van D. Gooch, J. C. Thoen (Division of Science & Math, Univ. Minnesota, Morris Mn.):
Time lapse video of circadian conidiation in *Neurospora*.
- B-17 P.Hardin (Department of Biology, Texas A & M University, College Station, Texas):
Circadian cycling of *period* mRNA is correlated with nuclear localization of *period* protein.
- B-18 J. P. Harney, K. Scarborough, K. Rosewell, P. M. Wise (Department of Physiology, University of Kentucky College of Medicine, Lexington, KY; Department of Neurobiology and Physiology, Northwestern University, Evanston, IL):
Effect of intracranial infusion of VIP antisense oligonucleotides into the suprachiasmatic nuclei (SCN) on the LH surge in the rat.

- B-19 **Michaela Hau** (Max Planck Institut für Verhaltensphysiologie, Andechs, Germany):
Entrainment of house sparrow circadian rhythms to feeding cycles with different food access times.
- B-20 **Sabine Heigl** (Max Planck Institut f. Verhaltensphysiologie, Abt. Gwinner, Andechs, Germany)
Periodic food availability entrains circadian rhythms in pinealectomized house sparrows.
- B-21 **Martha Hotz Vitaterna, Phil L. Lowrey, David McDonald, William F. Dove, Lawrence H. Pinto, Fred W. Turek, Joseph S. Takahashi** (NSF Center for Biological Timing, Department of Neurobiology and Physiology, Northwestern University, Evanston, IL; McArdle Laboratory for Cancer Research, University of Wisconsin Medical School, Madison, WI):
Identification of a circadian clock mutant in the mouse.
- B-22 **Norio Ishida, Miwa Matsui, Youji Mitsui** (National Institute of Bioscience and Human Technology, AIST, MITI, Tsukuba Science City 305, Japan):
Circadian and light regulation of pp2.5 mRNA in the Suprachiasmatic Nucleus of rat brain.
- B-23 **Janet E. Joy** (NIMH Neuroscience Center at Saint Elizabeths, Washington, D.C.):
Proteins associated with the maturation of the circadian clock in the reproductive tract of the male Gypsy moth.
- B-24 **S.B.S.Kalsa, D.Whitmore, B.Bogart, G.D.Block** (Department of Biology, University of Virginia, Charlottesville, VA):
Evidence for direct involvement of transcription in the timing mechanism of a circadian pacemaker.
- B-25 **Hak Yong Kim, Gary G. Coté, Richard C. Crain** (Dept. of Molecular and Cell Biology, Univ. of Connecticut, Storrs, CT):
Circadian rhythmic regulation of light-responsive potassium channels in protoplasts from *Samanea saman* pulvini.

A-27 MOUSE MUTANT WITH ALTERED CIRCADIAN RHYTHM: PRELIMINARY
BEHAVIORAL AND GENETIC ANALYSIS

Gary E. Pickard^{1,2,5}, Patricia J. Sollars^{1,5}, Eugene M. Rinchik⁶, Allan I. Pack^{3,5} and
Maja Bucan^{1,4,5}

Departments of Psychiatry¹, Neuroscience², Medicine³ and Genetics⁴, Center for Sleep
and Respiratory Neurobiology⁵, University of Pennsylvania School of Medicine,
Philadelphia, PA and Division of Biology⁶, Oak Ridge National Laboratory, Oak Ridge,
TN.

A-28 THE USE OF DIFFERENTIAL DISPLAY IN THE ANALYSIS OF GENE
EXPRESSION IN SCN

Patrick Nolan¹, Patricia J. Sollars^{1,4}, Kathy Siwicki⁵, Gary E. Pickard^{1,2,4} and Maja
Bucan^{1,3,4}

Departments of Psychiatry¹, Neuroscience², and Genetics³, Center for Sleep and
Respiratory Neurobiology⁴, University of Pennsylvania School of Medicine, Philadelphia,
PA and Department of Biology⁵, Swarthmore College, Swarthmore, PA.

B-26 Michael Roberts - "Nitric Oxide Synthase
in the eye of Bulla:"

B-27 Piotr Zlomanczuk "Melatonin
sensitivity in SCN
neurons in
Djungarian hamsters
exposed to constant
light"

CHRONOBIOLOGY - COLBY SAWYER COLLEGE (S)
CONFEREES COMMENTS

SCIENCE:

1. Excellent scientifically and socially.
2. The conference was excellent, timely, and covered new developments.
3. A good conference with most papers at the cutting edge. As a plant biologist, I must say that it was a pity that there was only one talk on higher plants but this does reflect the fact that there are rather few people studying higher plant rhythm all this time.
4. Chronobiology conference excludes clinical research. Some lectures were too long or poor.
5. More papers on human rhythms and medical implications needed.
6. There seems to be a split between those involved in molecular techniques and those involved from a more biological/behavioral point of view. Maybe that will change with time.
7. It seems that several of the talks represented projects that are possibly promising and interesting, but have been presented in a far from convincing and complete format for the past (at least) 1.5 years. It seems that some quality control may be possible, or some way to communicate displeasure with presenters for their own quality control.

DISCUSSION:

8. Discussion/session leaders need to insure that all hear the questions and comments from the audience by a brief recap or restatement.

MANAGEMENT:

9. Poster sessions could be held in the evening after 6:30 p.m. and the evening talks in the afternoon.
10. Great conference. Good balance of topics (light on human). Easy to talk to people. Speakers were excellent. Poster were excellent. Dividing the posters into 4 sessions and leaving them up for two days was helpful. Hold the next chronobiology conference in Newport, R.I. on the beach!
11. I've been to all of the Gordon Conferences on chronobiology (one of 2 people) and thought that this had the best organization of all of them!
12. Some speakers were not well selected. Please speak at a moderate speed. Some speakers spoke too fast and non-natives could not catch up. Questions should be made using a microphone. We need several microphones among audiences.
13. Interdisciplinary mix was good. In a future meeting, I would like to see a sleep/rhythm mix. It would be good to try some poster discussion sessions allowing presenters 1 or 2 slides.
14. Mix it up. Why one whole day of molecular then nothing the rest of the conference?

CHRONOBIOLOGY - COLBY SAWYER COLLEGE (S)
CONFEREES COMMENTS

15. The meeting was unusually current and interactive. The chair promoted a relaxed pace combined with presentations of new, highly visible research findings. The combination was invigorating! Great job.
16. Goals, themes, objectives? I've never heard anyone actually state these. I'm not sure I'd want to. Poster sessions would be improved if even posters were one day, and odd posters the next instead of 1-13 and 14-26. This would take advantage of the entire room and reduce crowding.
17. As usual, a wonderful conference. This year's organizers were outstanding in putting together a high quality meeting.
18. There should have been more presentations per day or a shorter conference.
19. Lets go to Italy!
20. The morning session would be better if there were 2 speakers, then coffee, and then the final speaker, for attention span reasons. Overall, I like the structure of 3 morning speakers and 2 evening speakers and then a summary.
21. An excellent meeting! Probably the best "rhythms" meeting I've attended. The chair has put together an outstanding program, highlighting excellent work from many different labs, including many relative newcomers to the field. The speakers have been uniformly impressive, presenting new approaches and exciting new results.
22. Small group/subtopic meeting might be schedule on one evening.
23. I would have liked to receive abstracts of the posters.

ATMOSPHERE:

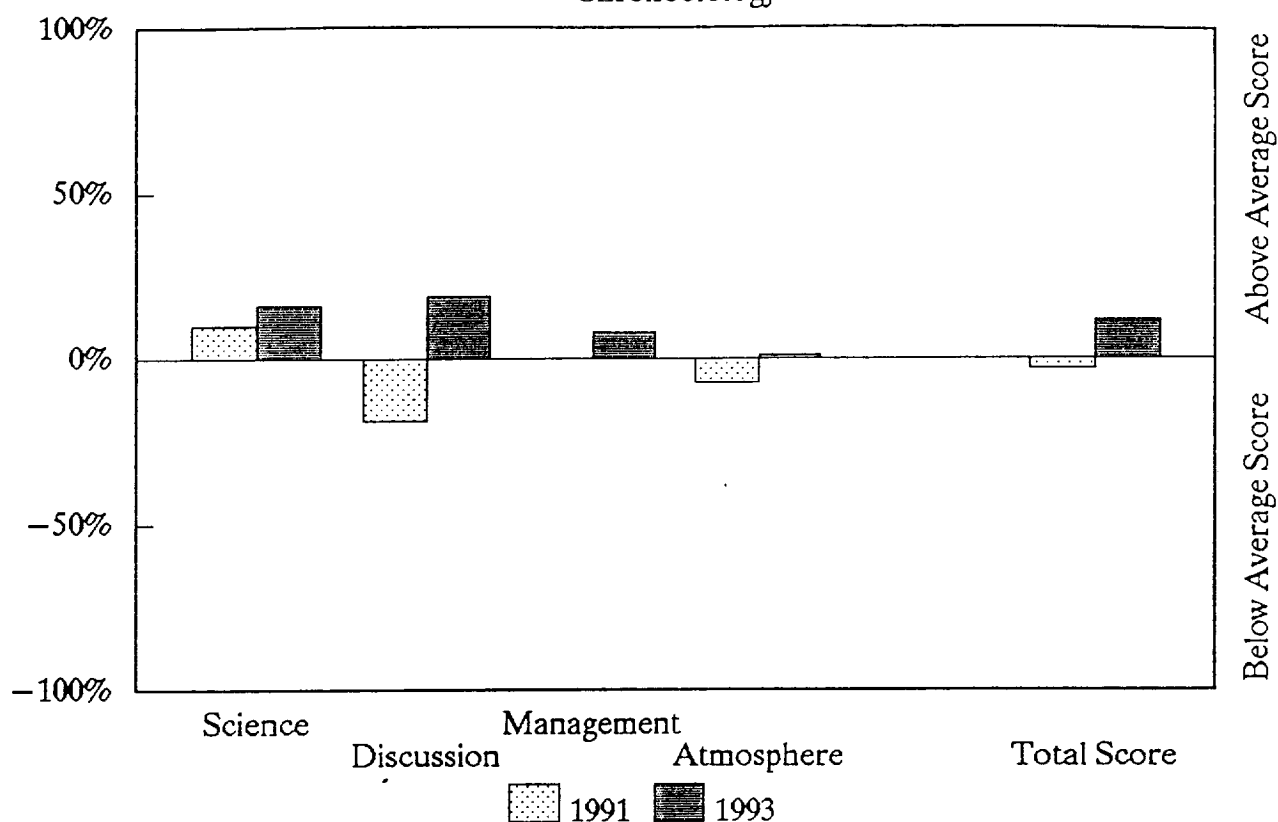
24. Great conference.
25. Excellent - The best chronobiology conference to date and all have been good.
26. Excellent.
27. Fantastic conference - the best of the several excellent chronobiology Gordon Conferences I have attended over the last 8 years, and more stimulating than G.C.s I have attended on other subjects.
28. This continues to be stimulating and very important to the field in spite of proliferation of related meetings (e.g. neuroscience, soc. study of biological rhythms).
29. This conference continues to attract the best scientists in the field and in increasing numbers. The meeting has played an important role in the development of the field, especially the interactions between U.S. and European workers.
30. The best Gordon Conference overall that I have attended (I've done 4).
31. Excellent conference! Very informative.

CHRONOBIOLOGY - COLBY SAWYER COLLEGE (S)
CONFEREES COMMENTS

32. In general, I am very happy to be here and I wish to attend this type of G.R.C. again and again.
33. The best conference that I have ever been to.

1993 Overall Conference Comparison

Chronobiology



CONFERENCE SCORES: Chronobiology

Conference Scores:	1993	1991	Average Conference Scores
Science:	25.45	24.13	21.93
Discussion:	20.27	13.85	17.08
Management:	15.74	14.56	14.56
Atmosphere:	15.83	14.48	15.61
Total Score:	77.29	67.02	69.19

Gordon Research Conferences